EFFECT OF SOLVENT-DEPENDENT VISCOELASTIC PROPERTIES OF CHITOSAN MEMBRANES ON THE PERMEATION OF LOW MOLECULAR WEIGHT DRUGS

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Chitosan (CTS), a widely used biopolymer in different biomedical applications, is a derivative of chitin, the most abundant polysaccharide found in the marine world.
This work aimed at providing relevant information about the use of CTS membranes in separation applications or in sustained release systems of therapeutic molecules. Moreover, the mechanical characterization may be also very important in such kind of applications, especially if the materials are tested in adequate physiological conditions.
Chitosan membranes, both non-crosslinked and crosslinked with genipin, were characterized by dynamic mechanical analysis, swelling and permeability experiments using a model molecule. The membranes were tested immersed in different mixtures of water/ethanol. The swelling equilibrium varied linearly with the volumetric composition of the solvent mixture. The mechanical properties of CTS increased with the enhancement of the crosslinking density. A peak of the loss factor appeared at 24.5% of water attributed to the α-relaxation of chitosan and simultaneously a reduction of the storage modulus was observed. This was the first time that the glass transition (T_g) dynamics was monitored in a polymer in immersion conditions, where the plasticizer composition in the bath changed in a controlled way. Permeability decreased sharply until it reached very small values around the T_g.
We hypothesise that conformational mobility of the polymeric chains may play an important role in the diffusion properties of molecules through polymer matrices. Results may elucidate some aspects regarding to relationships between glass transition and transport properties that may be important in the use of CTS in TE strategies.